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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/517,314	03/02/2000	Chih-Chen Cho	M4065.0223/P223	5039
24998	7590	11/03/2003	EXAMINER	
DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP			KANG, DONGHEE	
2101 L STREET NW			ART UNIT	
WASHINGTON, DC 20037-1526			PAPER NUMBER	
			2811	

DATE MAILED: 11/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/517,314

Applicant(s)

CHO, CHIH-CHEN

Examiner

Donghee Kang

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 September 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-11,13-17,25 and 27-39 is/are pending in the application.
- 4a) Of the above claim(s) 33-38 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-11,13-17,25,27-32 and 39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on September 15, 2003 has been entered.

Drawings

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the phrase "*a polymer layer formed over at least a portion of said etch-stop layer*" in claims 11 & 25 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims **1,3-4 & 9-10** are rejected under 35 U.S.C. 103(a) as being unpatentable over Fig.11 of Chiang et al. (US 5,739,579) in view of Fig.9 of Chiang et al. (US 5,739,579).

Chiang teaches a semiconductor structure comprising (Fig.11):

an insulator layer (22); a conductive plug (100) positioned within said insulator layer and formed of a single conductive material; doped region (21) connected to said conductive plug (100); an etch-stop layer (23) located on said insulator layer and surrounding said plug, wherein said etch-stop layer comprises silicon nitride or silicon carbide; a non-conductive layer (101) having an etched via at least partially over said conductive plug, wherein said etches via is wider in diameter than said conductive plug; and a conductive connector (102) formed in said via in electrical contact with said plug. Chiang does not teach in Fig.11 the conductive connector including a first conductor layer and a second conductor layer.

However, Chiang teaches in alternate embodiment Fig.9 the conductive connector including a TiN first (60) and Cu second (61) conductor layers (Col.8, lines 55-67, Col.11, lines 12-48 & Col.14, line 65-Col.15, line 3). It is conventional to use copper (Cu) with a barrier layer as a conductive interconnection layer instead of aluminum (Al) because copper has a lower resistivity than aluminum hence providing a higher speed. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the aluminum with copper/barrier layer since the copper layer provides higher speed than aluminum hence to obtain higher density in ICs.

5. Claims **5-6** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al. in view of Wang (US 6,184,128).

Regarding claim **5**, Chiang et al. teach the entire claimed invention, as applied to claim 1 explained above, except for non-conductive layer (etch-stop layer) comprising a silicon dioxide. Wang teaches in Fig.7 the silicon dioxide layer acts as an etch-stop layer (Col.5, lines 49-64).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silicon nitride of Chiang with a silicon dioxide as taught by Wang in order to provide the etch-stop layer in Chiang's device. Furthermore, one of ordinary skill in the art would have recognized that the silicon nitride and silicon dioxide are both considered to be an art recognized functional equivalent for serving as an etch-stop layer for BPSG dielectric layer.

Regarding claim **6**, Chiang et al. do not teach the non-conductive layer (etch-stop layer) comprising silicon nitride and silicon carbide. However, Wang teaches in Fig.7 the etch-stop layer including the silicon nitride and silicon carbide layer (Col.5, lines 49-64). It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silicon nitride of Chiang with a silicon nitride and silicon carbide as taught by Wang in order to provide the etch-stop layer in Chiang's device.

Moreover, it would have been obvious to one of ordinary skill in the art to form the etch-stop layer using silicon nitride and silicon carbide stack layer as taught by Wang, since it has been held to be within the general skill of a worker in the art to select

a known material on the basis of its suitability for the intended use as matter of obvious design choice. In re Leshin, 125 USPQ 416.

6. Claims **7-8** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al. (US 5,739,579) and further in view of Hong et al. (US 6,008,117).

Chiang et al. do not teach the non-conductive layer further comprising borophosphosilicate glass (BPSG) layer. However, Hong et al. teach in Fig.1H the non-conductive layer comprising BPSG (Col.3, lines 16-19). It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the Silicon dioxide of Chiang with a BPSG material as taught by Hong in order to provide a dielectric layer which has a less etch rate than etch-stop layer.

7. Claims **11, 15-17, 25, 27, 30-32 & 39** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al. (US 5,739,579).

Regarding claims **11, 25, 27 & 32**, Chiang et al. teach a semiconductor comprising (Fig.25):

An active region in a substrate (321); a conductive plug (340 & 343) formed within an insulator layer (322) and provided over said active region, said conductive plug being electrically connected with said active region; an etch-stop layer (323) deposited on said insulator layer; a polymer layer (350, Col.15, lines 38-45) formed over at least a portion of said etch-stop layer; an intermediate non-conductive layer (390-395) provided over said etch stop and polymer layers and having an at least first and a

second etched via over said plug, said second etched via is being wider in diameter than said first etched via; and a first conductive layer (393 & 396) disposed in and in contact with said first and second via, said first conductive layer including a portion in contact with said conductive plug, and a second conductive layer deposited over and in contact with said first conductive layer.

Chiang does not teach a processing unit which is coupled to a semiconductor device. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have a processor unit in processor-based device, since the processor is required in the processor-based device to operate a device.

Regarding claims **15-16 & 30-31**, Chiang teaches the first conductive layer and the second conductive layer comprising titanium nitride and copper, respectively.

Regarding claims **17 & 39**, Chiang does not expressly teach a plurality of memory cells. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form a plurality of memory cells, since it has been held that mere of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co.v.Bemis Co.*, 193 USPQ 8.

8. Claims **13-14 & 28-29** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al. in view of Hong (US 6,008,117).

Chiang et al. do not teach non-conductive layer comprising BPSG material. However, Hong et al. teach the non-conductive layer disposed on the etch-stop comprising BPSG (Col.3, lines 6-19). It would have been obvious to one of ordinary skill

in the art at the time the invention was made to substitute the Silicon dioxide of Chiang with a BPSG material as taught by Hong in order to provide a dielectric layer which has a less etch rate than etch-stop layer.

Response to Arguments

9. Applicant's arguments filed 31 December 2002 have been fully considered but they are not persuasive.

Applicant argues that Chiang et al. fail to teach a polymer layer. This is not convincing because claim 1 does not include this limitation.

Chiang et al. teach in Fig.25 a polymer layer formed over the etch-stop layer.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 703-305-9147. The examiner can normally be reached on Maxiflex.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C Lee can be reached on 703-308-1690. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.



Donghee Kang
Examiner
Art Unit 2811